



URBAN WET WEATHER FLOW (WWF) MANAGEMENT AND CONTROL

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LTG 3 Poster 04

Science Questions

LTG 3, Science Question #2

What BMP treatment systems and restoration technologies remain as uncertain options for watershed management when considering treatment of priority stressors in stormwater runoff from single and mixed land use watersheds?

Research Question

How can more cost-effective approaches to manage and control WWF pollution be developed?

How Research Addresses the Water Quality MYP Goals

Research results will provide cost-effective methods and techniques to manage WWF stressor loads (nutrients, pathogens, sediments, flow, and toxicants). Current activities are emphasizing improved characterization and management practices to control/treat stormwater runoff to protect human health and aquatic ecosystems. Collaborations with other labs, centers, agencies and municipalities allows leveraging of resources and access to full-scale evaluations of research results at sites of opportunity.

Research Objectives

The objective of this research is to develop and demonstrate cost-effective approaches to manage and control WWF pollution in the urban environment. Activities focus on improved problem definition (i.e., characterization of urban runoff), less costly nonstructural and structural best management practices (in particular, retention ponds, constructed wetlands, bioretention, swales, green roofs, stream enhancements) that reduce the impacts of WWF-related stressors on receiving waters, decision support tools, CSO and SSO treatment and control strategies, and select studies to support regulatory development and implementation.

Research Methods & Collaboration

Research methods rely on bench-, pilot-, and full-scale demonstration studies at sites-of-opportunity.

Problem Definition/Source Characterization

- Monitoring and statistical analyses of nutrient, solids, pathogen, and toxicant stressors to identify and characterize sources, fate, and transport
- Collaborators: Reg. II, Reg. III, Interstate Environmental Commission (IEC), NYCDEP

Treatment and Control Techniques

- Bench treatability studies, model to prototype projects, field studies
- Projects: Green roofs, multi-chambered treatment train (MCCT), upflow filters, real time control (RTC) of CSO/SSO, stream restoration, blending
- Collaborators: Reg. III, Univ. of Alabama, Penn State Univ., Milwaukee, WI, Quebec City, Ont., Fairfax, VA, NYCDEP

Decision Support Tools

- Model and model framework development and validation
- Projects: Sanitary Sewer Overflow Analysis and Planning (SSOAP) Toolbox and the Stormwater Treatment and Analysis Framework
- Collaborators: Prince Georges County, MD; CDM; EPA Reg III

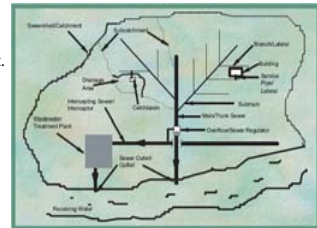
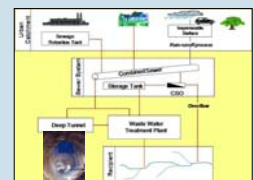


Illustration of a combined sewer system



Land use study sites to characterize urban watershed runoff for multiple stressors of concern



Real time control of CSO, Milwaukee, WI



Green roof research, Penn State University, PA

Research Results

Problem Definition/Source Characterization

- Modified method 1623 for detection of *Cryptosporidium*/*Giardia* in stormwater
- Cryptosporidium* found in 50% and *Giardia* in 60% of stormwater samples
- High density residential areas had the highest microorganism concentration over low density residential and landscaped commercial land uses
- Significant quantities of toxicants associated with concomitant particle size

Treatment and Control Techniques

- Green roofs reduce runoff volume and buffer pH values in acid rain environments
- RTC strategies reduced CSOs to the St. Charles and St. Lawrence Rivers from over 50 to less than seven; eliminated basement surcharges; and made optimal use of WWTPs and inline tunnels during peak flows
- Patent for vacuum flushing system/methodology to manage and control sewer solids
- MCTT removes greater than 80% of most stressors from stormwater; upflow filters significantly reduce toxicants greater than 0.45 µm
- Filter fence design aid for sediment control at construction sites

Decision Support

- The SSOAP Toolbox is successful in analyzing impacts of rainfall derived infiltration and inflow (RDII) on the capacity of sanitary sewer systems. It also aids in developing sound capital improvement plans to mitigate pollution from SSOs
- Stormwater Treatment and Analysis Framework provides a decision making tool based on optimal water quality and cost analyses while relying on the SWMM for landscape runoff and flow routing of stormwater and sewers

Research Conclusions & Future Directions

Problem Definition/Source Characterization

Concern for pathogens such as *Giardia* and *Cryptosporidium*, land use, and climate should be considered when evaluating and managing the risks of urban runoff. Pollutant-associated particle size is important for design and function of BMPs. Future activities will investigate emerging contaminants such as EDCs, personal care products, and nanoparticles.

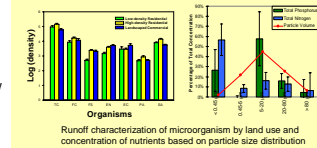
Treatment and Control Techniques

Green roofs can be a viable stormwater treatment option. The performance of RTC strategies and cost effectiveness in controlling overflows make this treatment a promising tool for large municipalities. MCCT and upflow filter treatment devices can be used in treating "hot spots", e.g., vehicular service stations, successfully reducing toxicants in receiving waters. Additional evaluations at actual sites of opportunity are required to further document performance and costs.

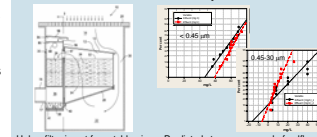
Decision Support

SSOAP and Stormwater Treatment and Analysis Framework (using SWMM) provide for the development of decision support tools to plan, design, evaluate, and manage WWF pollution abatement approaches, techniques, and alternatives in a cost-effective manner. More research is needed to maximize the utility of these tools.

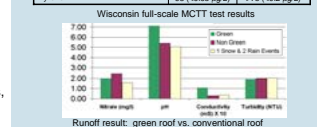
Problem Definition/Source Characterization



Treatment and Control Techniques

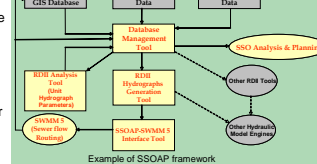


Median % reductions (median effluent concentration)	Milwaukee (15 events)	Milwaukee (7 events)
Suspended Solids	98 (<5 µg/L)	85 (<10 µg/L)
Phosphorus	88 (0.02 mg/L)	>40 (<0.1 mg/L)
Copper	90 (3 µg/L)	65 (15 µg/L)
Lead	98 (1.6 µg/L)	64 (<0.5 µg/L)
Zinc	91 (<20 µg/L)	90 (15 µg/L)
Benzo (b) Fluoranthene	>95 (<0.1 µg/L)	>75 (<0.1 µg/L)
Phenanthrene	99 (<0.05 µg/L)	>65 (<0.2 µg/L)
Pyrene	98 (<0.05 µg/L)	>75 (<0.2 µg/L)



Runoff result: green roof vs. conventional roof

Decision Support



Interactions with Customers

- OWM/NRMRL Manual for detecting unauthorized connections into storm systems
- Reg II/NRMRL *Enterococcus* die-off studies support of pathogen TMDL model for NY/NJ Harbor
- OWM/OSP/Reg II/NRMRL/NERL/IEC/ NYCDEP: provide guidance on blending for regulated communities with SSOs
- Developed modified method 1623 with Reg II
- SSOAP Toolbox is used by SSO communities for analysis and development of SSO control plans
- RTC development and workshops with Milwaukee and Toronto
- Presentations at international and national conferences, hosting of local seminars, and providing reports, books, journal articles, and research plans on our website (www.epa.gov/ednrmrl)

How Research Contributes to Outcomes

Research products are providing guidance and tools that allow municipalities to develop cost-effective approaches to meet CSO and stormwater NPDES permit requirements. They also support the Program Offices in strengthening and implementing NPDES and TMDLs requirements to mitigate stormwater, CSO and SSO pollution. Products continue to address protection of public health and improvements to aquatic systems on a watershed basis.